Amendments to the Claims

Please amend Claims 8 and 17 and consider new dependent claims 22 through 29 as shown below. This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

1. (Previously Presented) A method of monitoring machining in an electrochemical machining tool assembly having first and second tools arranged on opposite sides of a workpiece so as to define first and second gaps with said workpiece, said method comprising:

mounting a first ultrasonic transducer in said first tool;

mounting a second ultrasonic transducer in said second tool;

generating ultrasonic waves with said first and second ultrasonic transducers;

detecting arrival times of reflections of said ultrasonic waves at said first and second ultrasonic transducers; and

using said arrival times to calculate at least one of said first gap size, said second gap size, and thickness of said workpiece, wherein said first gap size is calculated multiplying said first gap ultrasonic time-of-flight by the ultrasound velocity in said first gap and dividing the resulting product by two.

2. (Original) The method of claim 1 wherein said step of detecting arrival times includes;

detecting a first arrival of an ultrasonic wave reflected from said first tool;

detecting a second arrival time of an ultrasonic wave reflected from a first side of said workpiece;

detecting a third arrival time of an ultrasonic wave reflected from said second tool; and

detecting a fourth arrival time of an ultrasonic wave reflected from a second side of said workpiece.

3. (Original) The method of claim 2 wherein said step of using said arrival times to calculate at least one of said first gap size, said second gap size, and thickness of said workpiece includes calculating the ultrasonic time-of-flight in said first gap by subtracting said

first arrival time from said second arrival time and calculating the ultrasonic time-of-flight in said second gap by subtracting said third arrival time from said fourth arrival time.

4. (Cancelled)

5. (Original) The method of claim 3 wherein said step of using said arrival times to calculate at least one of said first gap size, said second gap size, and thickness of said workpiece further includes calculating said second gap size by multiplying said second gap ultrasonic time-of-flight by the ultrasound velocity in said second gap and dividing the resulting product by two.

6. (Original) The method of claim 3 wherein said step of using said arrival times to calculate at least one of said first gap size, said second gap size, and thickness of said workpiece further includes:

calculating said first gap size by multiplying said first gap ultrasonic time of-flight by the ultrasound velocity in said first gap and dividing the resulting product by two;

calculating said second gap size by multiplying said second gap ultrasonic time-of-flight by the ultrasound velocity in said second gap and dividing the resulting product by two; and

calculating said workpiece thickness by subtracting said first gap size and said second gap size from the distance between said first and second tools.

7. (Original) The method of claim 1 further comprising detecting a position of a machined portion of said workpiece relative to a workpiece datum.

8. (Currently Amended) A method of monitoring machining in an electrochemical machining tool assembly having first and second tools, said method comprising:

mounting a first ultrasonic transducer in said first tool;

mounting a second ultrasonic transducer in said second tool;

situating a workpiece between said first and second tools so as to define a first gap between said first tool and said workpiece and a second gap between said second tool and said workpiece;

connecting a source of electric power to said first and second tools and to said workpiece;

flowing ~~an~~ <u>a liquid</u> electrolytic fluid through said first and second gaps;

generating ultrasonic waves with said first and second ultrasonic transducers;

detecting a first arrival time of an ultrasonic wave reflected from an interface between said electrolytic fluid and said first tool;

detecting a second arrival time of an ultrasonic wave reflected from an interface between said electrolytic fluid and a first side of said workpiece;

detecting a third arrival time of an ultrasonic wave reflected from an interface between said electrolytic fluid and said second tool; and

detecting a fourth arrival time of an ultrasonic wave reflected from an interface between said electrolytic fluid and a second side of said workpiece; and

using said arrival times to calculate at least one of said first gap size, said second gap size, and thickness of said workpiece.

9. (Original) The method of claim 8 wherein said step of using said arrival times to calculate at least one of said gap size, said second gap size, and thickness of said workpiece includes calculating the ultrasonic time-of-flight in said first gap by subtracting said first arrival time from said second arrival time and calculating the ultrasonic time-of-flight in said second gap by subtracting said third arrival time from said fourth arrival time.

10. (Original) The method of claim 9 wherein said step of using said arrival times to calculate at least one of said first gap size, said second gap size, and thickness of said workpiece further includes calculating said first gap size by multiplying said first gap ultrasonic time-of-flight by the ultrasound velocity in said first gap and dividing the resulting product by two.

11. (Original) The method of claim 9 wherein said step of using said arrival times to calculate at least one of said gap size, said second gap size, and thickness of said workpiece further includes calculating said second gap size by multiplying said second gap ultrasonic time-of-flight by the ultrasound velocity in said second gap and dividing the resulting product by two.

12. (Original) The method of claim 9 wherein said step of using said arrival times to calculate at least one of said gap size, said second gap size, and thickness of said workpiece further includes:

calculating said first gap size by multiplying said first gap ultrasonic time-of-flight by the ultrasound velocity in said first gap and dividing the resulting product by two;

calculating said second gap size by multiplying said second gap ultrasonic time-of-flight by the ultrasound velocity in said second gap and dividing the resulting product by two; and

calculating said workpiece thickness by subtracting said first gap size and said second gap size form the distance between said first and second tools.

13. (Original) The method of claim 8 further comprising applying an acoustic couplant between said first ultrasonic transducer and said first tool and applying an acoustic couplant between said second ultrasonic transducer and said second tool.

14. (Original) The method of claim 8 further comprising disconnecting said source of electric power while generating ultrasonic waves with said first and second ultrasonic transducers and detecting said arrival times.

15. (Original) The method of claim 8 further comprising regulating said source of electric power to minimize gas bubble generation on said first and second tools.

16. (Original) The method of claim 8 further comprising detecting a position of a machined portion of said workpiece relative to a workpiece datum.

17. (Currently Amended) An electrochemical machining tool assembly comprising:

first and second tools spaced apart from one another so that a workpiece can be located therebetween;

a first ultrasonic transducer mounted in said second tool;

an acoustic couplant between said first ultrasonic transducer and said first tool;

a second ultrasonic transducer mounted in said second tool; and

means for calculating gap sizes and workpiece thickness from arrival time at said first and second ultrasonic transducers of reflections of ultrasonic waves generated by said first and second ultrasonic transducers;

wherein the acoustic couplant is selected from the group consisting of: a gel, a high viscosity oil, a low viscosity oil, or an aqueous couplant.

18. (Original) The assembly of claim 17 wherein said first tool defines a first cutting surface, said second tool defines a second cutting surface, and said first and second ultrasonic transducers are both located on an axis that extends normal to both of said first and second cutting surfaces.

19. (Original) The assembly of claim 17 wherein said first and second ultrasonic transducers comprise contact transducers.

20. (Original) The assembly of claim 17 wherein said first and second ultrasonic transducers comprise immersion transducers.

21. (Previously Presented) The assembly of claim 17 further comprising an acoustic couplant between said second ultrasonic transducer and said second tool.

22. (New) The assembly of claim 17 wherein said acoustic couplant is a gel.

23. (New) The assembly of claim 17 wherein said acoustic couplant is a high viscosity oil.

24. (New) The assembly of claim 17 wherein said acoustic couplant is a low viscosity oil.

25. (New) The assembly of claim 17 wherein said acoustic couplant is an aqueous couplant.

26. (New) The assembly of claim 21 wherein said acoustic couplant is a gel.

27. (New) The assembly of claim 21 wherein said acoustic couplant is a high viscosity oil.

28. (New) The assembly of claim 21 wherein said acoustic couplant is a low viscosity oil.

29. (New) The assembly of claim 21 wherein said acoustic couplant is an aqueous couplant.